What is claimed is:

1. An ink-jet recording apparatus comprising:

(a) a nozzle of an ink channel in a recording head, from which an ink droplet is jetted; and

(b) an electromechanical converting device for changing a volume of the ink channel to make the ink droplet to jet from the nozzle,

wherein before an ink droplet jetting operation is conducted, an ink meniscus in the nozzle is vibrated finely by repeating plural times a pushing out process so that a distance corresponding to a peak of the ink meniscus pushed out from a surface of the nozzle is equal to or more than a radius of the nozzle and a process for pulling in more toward the ink channel across a repose position of the ink meniscus, while the ink is prevented from jetting from the nozzle.

2. The ink-jet recording apparatus of claim 1, wherein drive signals having a voltage pulse with a pulse width of $(N_1)AL$ for expanding the volume of the ink channel, a first pause period with a width of $(N_2)AL$, a voltage pulse with a pulse width of $(N_3)AL$ for reducing the volume of the ink channel, and a second pause period with a width of $(N_4)AL$ are

applied repeatedly plural times to the electromechanical converting device, thereby a fine vibration of the ink meniscus is conducted, where AL represents a half of an acoustical resonance period of the ink channel, each of N_1 and N_3 is an integer of 2 or more, and each of N_2 and N_4 is a real number of 1 or more.

3. The ink-jet recording apparatus of claim 1, wherein drive signals having a voltage pulse of rectangular wave with a pulse width of $(N_1)AL$ for expanding the volume of the ink channel, a first pause period with a width of $(N_2)AL$, a voltage pulse of rectangular wave with a pulse width of $(N_3)AL$ for reducing the volume of the ink channel, and a second pause period with a width of $(N_4)AL$ are applied repeatedly plural times to the electromechanical converting device, thereby a fine vibration of the ink meniscus is conducted, where AL represents a half of an acoustical resonance period of the ink channel, each of N_1 and N_3 is an integer of 2 or more, and each of N_2 and N_4 is a real number of 1 or more.

4. The ink-jet recording apparatus of claim 3, wherein each of N_2 and N_4 is an integer of 1 or more.

5. The ink-jet recording apparatus of claim 3, wherein each of N_1, N_2, N_3 and N_4 is 4.

6. The ink-jet recording apparatus of claim 3, wherein a jetting drive voltage that makes the ink droplet to jet from the nozzle in the recording head and to record images, is equal to a fine vibration drive voltage that vibrates finely the ink meniscus without making the ink to jet from the nozzle.

7. The ink-jet recording apparatus of claim 6, wherein when the recording head is outside an image recording area, an ink refreshing drive to spew ink is carried out by driving the electromechanical converting device, and each of a jetting drive voltage when the image recording is conducted, a fine vibrating drive voltage that makes the ink meniscus to vibrate finely and an ink refreshing drive voltage, is the same.

8. The ink-jet recording apparatus of claim 1, wherein a peak of fine vibration of an ink meniscus when the recording head is outside the image recording area, is

greater than that of fine vibration of an ink meniscus when the recording head is on non-recording pixel in the image recording area.

9. The ink-jet recording apparatus of claim 3, wherein the electromechanical converting device forms a partition wall between adjacent ink channels, and is of piezoelectric material that deforms under a shear mode.

10. An ink-jet recording apparatus comprising:

(a) a nozzle of an ink channel in a recording head, from which an ink droplet is jetted; and

(b) an electromechanical converting device for changing a volume of the ink channel to make the ink droplet to jet from the nozzle,

wherein drive signals having a voltage pulse with a pulse width of $(N_1)AL$ for expanding the volume of the ink channel, a first pause period with a width of $(N_2)AL$, a voltage pulse with a pulse width of $(N_3)AL$ for reducing the volume of the ink channel, and a second pause period with a width of $(N_4)AL$ are applied repeatedly plural times to the electromechanical converting device, thereby a fine vibration of the ink

meniscus is conducted, while the ink is prevented from jetting from the nozzle,

where each of N_1 and N_3 is an integer of 2 or more, each of N_2 and N_4 is a real number of 1 or more, and AL represents a half of an acoustical resonance period of the ink channel.

11. An ink-jet recording apparatus comprising:

(a) a nozzle of an ink channel in a recording head, from which an ink droplet is jetted; and

(b) an electromechanical converting device for changing a volume of the ink channel to make the ink droplet to jet from the nozzle,

wherein drive signals having a voltage pulse of rectangular wave with a pulse width of (N_1)AL for expanding the volume of the ink channel, a first pause period with a width of (N_2)AL, a voltage pulse with a pulse of rectangular wave width of (N_3)AL for reducing the volume of the ink channel, and a second pause period with a width of (N_4)AL are applied repeatedly plural times to the electromechanical converting device, thereby a fine vibration of the ink meniscus is conducted, while the ink is prevented from jetting from the nozzle,

where each of N_1 and N_3 is an integer of 2 or more, each of N_2 and N_4 is a real number of 1 or more, and AL represents a half of an acoustical resonance period of the ink channel.

12. The ink-jet recording apparatus of claim 11, wherein each of N_2 and N_4 is an integer of 1 or more.

13. The ink-jet recording apparatus of claim 11, wherein each of N_1, N_2, N_3 and N_4 is 4.

14. The ink-jet recording apparatus of claim 11, wherein a jetting drive voltage that makes an ink droplet to jet from a nozzle in the recording head and to record images, is equal to a fine vibration drive voltage that vibrates finely an ink meniscus without making an ink to jet from the nozzle.

15. The ink-jet recording apparatus of claim 14, wherein when the recording head is outside an image recording area, an ink refreshing drive to spew ink is carried out by driving the electromechanical converting device, and each of a jetting drive voltage when the image recording is

conducted, a fine vibrating drive voltage that makes the ink meniscus to vibrate finely and a ink refreshing drive voltage, is the same.

16. The ink-jet recording apparatus of claim 11, wherein the electromechanical converting device forms a partition wall between adjacent ink channels, and is of piezoelectric material that deforms under a shear mode.

17. An ink-jet recording apparatus comprising:

(a) a nozzle of an ink channel in a recording head, from which an ink droplet is jetted; and

(b) an electromechanical converting device for changing a volume of the ink channel to make the ink droplet to jet from the nozzle,

wherein an ink meniscus in the nozzle is pushed out from a surface of the nozzle by a distance equal to or more than a nozzle radius, and thereby, the ink meniscus is vibrated finely while the ink is prevented from flying from the nozzle.

18. The ink-jet recording apparatus of claim 17, wherein the peak of the ink meniscus pushed out from a

surface of the nozzle is not more than three times the nozzle radius.

19. The ink-jet recording apparatus of claim 17, wherein drive signals having a voltage pulse of rectangular wave with a pulse width of $(N_1)AL$ for expanding the volume of the ink channel, a pause period with a width of $(N_2)AL$ and a voltage pulse of rectangular wave with a pulse width of $(N_3)AL$ for reducing the volume of the ink channel, are applied to the electromechanical converting device, where each of N_1, N_2 and N_3 is an integer of 2 or more and AL represents a half of an acoustical resonance period of the ink channel.

20. The ink-jet recording apparatus of claim 17, wherein in the recording head, a jetting drive voltage that makes an ink droplet to jet from a nozzle in the recording head, a fine vibration drive voltage that vibrates finely an ink meniscus without making an ink to jet from a nozzle and an ink refreshing drive voltage that spews ink outside an image recording area, are the same.

21. The ink-jet recording apparatus of claim 17, wherein a peak of a fine vibration of the ink meniscus when the recording head is outside an image recording area is greater than that of the fine vibration of an ink meniscus when the recording head is on non-recording pixel in the image recording area.

22. The ink-jet recording apparatus of claim 17, wherein the electromechanical converting device forms a partition wall between the adjacent ink channels, and is of piezoelectric material that deforms under the shear mode.